

Chigusa TAKAHASHI*: Variation of karyotypes in
Nandina domestica and its three cultivars

高橋ちぐさ*: ナンテンとその 3 園芸品種の核型の相違について

Nandina domestica (Berberidaceae) is a species distributed from India to east Asia. In Japan, it is found in the mountains in warmer regions of western Honshu, Shikoku and Kyushu. Within this species many cultivars are recorded, and the morphological variations are remarkable (Encyclopedia of Horticulture 1969). The chromosome number of this species was reported to be $2n=20$ (Langlet 1928, Miyaji 1930, Sugiura 1931, 1936, Kuroki 1967, Nakamura 1978). However, the chromosome number of the cultivars has not been reported yet. This paper deals with the karyotype analysis in wild *Nandina domestica* and its allied three cultivars.

Materials and methods The sources of the materials are listed in Tab. 1. For the observation of chromosomes, the orcein-squash method was applied. Root tips were pretreated in 0.002 M 8-hydroxyquinoline for 3-3.5 hours at 18-20°C and fixed in ethanol-glacial acetic acid (3:1) overnight at 5°C. Fixed materials were macerated in the solution of 45% acetic acid-1N HC1 (1:2) for 10-15 seconds at 60°C, and then stained with 2% aceto-orcein and squashed. Arm ratio was calculated by the method of Levan *et al.* (1964).

Observations

1) *Nandina domestica* Thunb. (Japanese name Nanten, Figs. 1A, 2A, 3A)

Eleven clones of this species were collected from seven localities (Tab. 1). They were normal in external morphology, that is, the plants were 1-2 m high, the leaves were 2- to 3-pinnately compound (Fig. 1A) and the fruits were red.

At metaphase, $2n=20$ chromosomes were counted in all of the eleven clones (Fig. 2A). This agrees with the previous reports of Langlet (1928), Miyaji (1930), Sugiura (1931, 1936), Kuroki (1967) and Nakamura (1978).

The chromosomes of the somatic complement varied gradually in length. The longest chromosome was $3.3 \mu\text{m}$, and the shortest one $1.4 \mu\text{m}$. The $2n=20$

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Tab. 1. Sources and chromosome number of *Nandina domestica* Thunb.

	Sources	No. of plants observed	Chromosome number (2n)
Wild type	Ikurado, Okayama Pref.	3	20
	Atetsukyo, Okayama Pref.	1	20
	Kamogata T., Okayama Pref.	1	20
	Buttsuji, Hiroshima Pref.	2	20
	Nokazuki, Asa T., Hiroshima Pref.	1	20
	Mimido, Mikawa V., Ehime Pref.	1	20
	Ehime Univ., Ehime Pref.	2	20
cv. Shironanten	Commercial sources		
	Daiei, Mihara C., Hiroshima Pref.	2	20
	Kozu Flower Shop, Imabari C., Ehime Pref.	6	20
	Karita Flower Shop, Imabari C., Ehime Pref.	2	20
	Shikoku Flower Shop, Kochi C., Kochi Pref.	1	20
cv. Himenananten	Commercial sources		
	Sato Flower Shop, Kamogata T., Okayama Pref.	2	20
	Murakami Flower Shop, Onomichi C., Hiroshima Pref.	1	20
	Karita Flower Shop, Imabari C., Ehime Pref.	5	20
cv. Otafukunanten	Commercial sources		
	Sato Flower Shop, Kamogata T., Okayama Pref.	1	20
	Daiei, Mihara C., Hiroshima Pref.	1	20
	Teramoto Flower Shop, Hiroshima C., Hiroshima Pref.	1	20
	Karita Flower Shop, Imabari C., Ehime Pref.	3	20

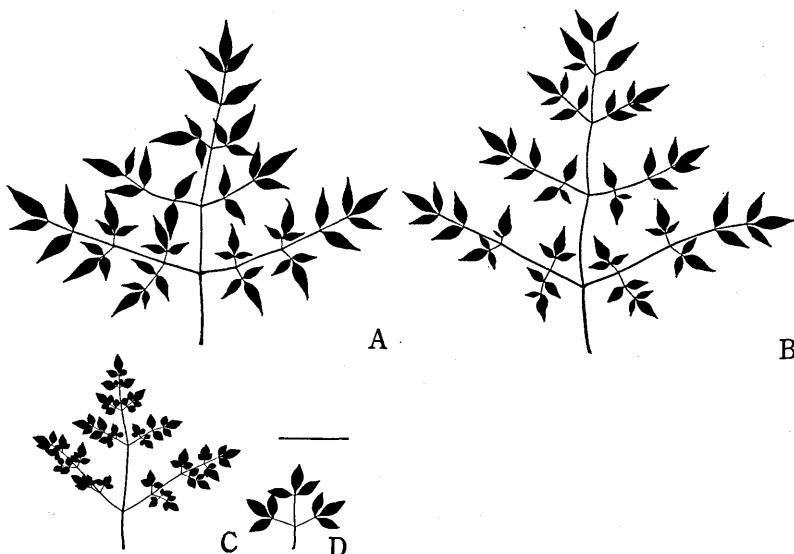


Fig. 1. Leaves of *Nandina domestica* and its three cultivars. A: *N. domestica*. B: cv. Shironanten. C: cv. Himenanten. D: cv. Otafukunanten. Bar indicates 10 cm.

chromosomes were classified into two groups according to the position of centromere and the chromosome length. The first group was composed of five pairs of chromosomes with median centromere, which varied in arm ratio ranging from 1.0 to 1.4 and in length ranging from $3.3 \mu\text{m}$ to $1.5 \mu\text{m}$ (Fig. 3A 1-10). Two of the five pairs (Fig. 3A 1-4) were from $3.3 \mu\text{m}$ to $2.6 \mu\text{m}$ in length and relatively longer than the others. The second group consisted of five pairs of subterminal chromosomes, which varied in arm ratio ranging from 3.5 to 4.7 and in length ranging from $1.7 \mu\text{m}$ to $1.4 \mu\text{m}$ (Fig. 3A 11-20). These results were compatible with the report of Kuroki (1967). Satellites were found in one of the pairs of subterminal chromosomes. The satellite was situated mostly in the distal end of the short arm of the sixth pair (Fig. 3A 11, 12). In some clones, the satellite was found in the seventh pair.

2) *Nandina domestica* Thunb. cv. Shironanten (Figs. 1B, 2B, 3B)

Eleven clones of this cultivar were examined (Tab. 1). These were distinct from the wild plants in having the following morphological characteristics: the fruits were white and the leaves were yellowish green and did not turn

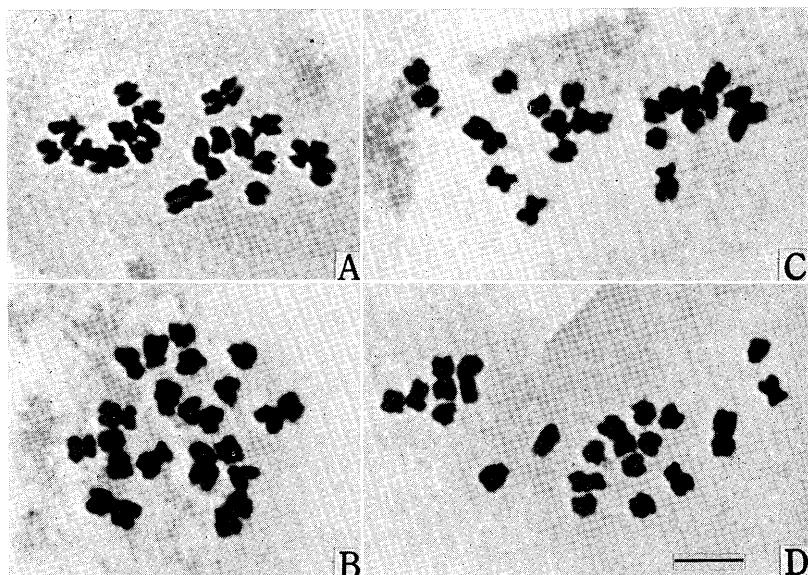


Fig. 2. Photomicrographs of somatic chromosomes at mitotic metaphase of *Nandina domestica* and its three cultivars. A: *N. domestica*. B: cv. Shironanten. C: cv. Himenananten. D: cv. Otafukunanten. Bar indicates 5 μm .

red in winter (Fig. 1A).

The chromosome number $2n=20$ was observed in all of the eleven clones (Fig. 2B). At metaphase, the longest chromosome was $2.9 \mu\text{m}$, the shortest one $1.3 \mu\text{m}$, and the chromosomes of the somatic complement varied gradually in length. In these respects, this cultivar was similar to the wild plants.

But the 20 chromosomes were grouped into two according to the position of centromere; four pairs of chromosomes had median centromere (Fig. 3B 1-8) and six pairs had subterminal centromere (Fig. 3B 8-20). In this respect, the cv. Shironanten was different from the plants of the wild type. That is, in cv. Shironanten there is one pair less of the median chromosomes and one pair more of the subterminal chromosomes than the wild type. Median chromosomes varied in arm ratio ranging from 1.0 to 1.3 and in length ranging from $2.9 \mu\text{m}$ to $1.8 \mu\text{m}$, which were found to be similar to those of the wild type. However, subterminal chromosomes varied in arm ratio ranging from 3.3 to 5.7, which was found to differ from those of the wild type. The fifth pair

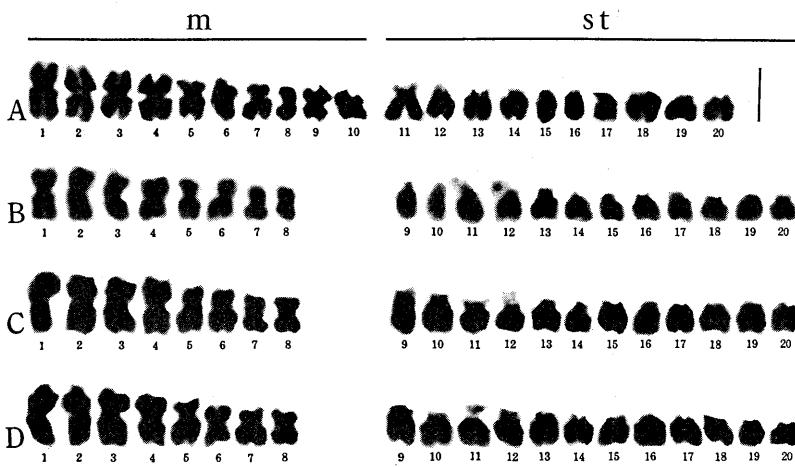


Fig. 3. Somatic chromosomes at mitotic metaphase of *Nandina domestica* and its three cultivars. A: *N. domestica*. B: cv. Shironanten. C: cv. Himenannten. D: cv. Otafukunanten. m: median centromere. st: subterminal centromere. Bar indicates 3 μ m.

(Fig. 3B 9, 10) had the highest arm ratio of 5.7. The length of the subterminal chromosomes varied ranging from 2.0 μ m to 1.3 μ m. A satellite was found in the distal end of the short arm in the sixth pair (Fig. 3B 11, 12).

3) *Nandina domestica* Thunb. cv. Himenannten (Fig. 1C, 2C, 3C)

Eight clones of this cultivar were studied (Tab. 1). The plants were dwarf in plant height ranging 30–50 cm and the leaflets were smaller than those of the wild *Nandina domestica* (Fig. 1C).

At metaphase, $2n=20$ chromosomes were counted in all of the eight clones (Fig. 2C). The chromosome length and the position of centromere were similar to those of the previous cv. Shironanten. That is, the 20 chromosomes were grouped into two: one consisting of four pairs with median centromere (Fig. 3C 1–8) and the other of six pairs with subterminal centromere (Fig. 3C 9–20). A satellite was also found in the distal end of the short arm in the sixth pair (Fig. 3C 11, 12).

4) *Nandina domestica* Thunb. cv. Otafukunanten (Figs. 1D, 2D, 3D)

Six clones of this cultivar were observed (Tab. 1). The plants were 40–60 cm high, the stems were slender, the leaves were mostly ternate or binate and the surface of leaflets were uneven (Fig. 1D).

At metaphase, $2n=20$ chromosomes were counted in all of the six clones (Fig. 2D). The chromosome length and the position of centromere were similar to those of cv. Shironanten and cv. Himenanthen. That is, the somatic complement consisted of four pairs with median centromere (Fig. 3D 1-8) and six pairs with subterminal centromere (Fig. 3D 9-20). A satellite was also found in the distal end of the short arm in the sixth pair (Fig. 3D 11, 12).

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Nandina domestica ナンテンの野生株と3園芸品種, シロナンテン, ヒメナンテン, オタフクナンテンについて核型の研究を行った。野生株の染色体数は $2n=20$ で, これは従来の報告と一致した。3園芸品種の染色体数も, いずれも $2n=20$ であった。しかし, 核型については両者は明らかに相違していた。野生株の染色体は5対の中部動原体型染色体と5対の次端部動原体型染色体から構成されていて, これはKuroki (1967) の報告とほぼ一致していた。これに対して, 3園芸品種はいずれも4対の中部動原体型染色体と6対の次端部動原体型染色体から構成されていた。すなわち, 3園芸品種は共に, 野生の株に比べて中部動原体型の染色体が1対少なく, 代って次端部動原体型の染色体が1対多かった。